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# THE NEWS LETTER

OF THE

## BUREAU OF PUBLIC ROADS



VOL. 2, NO. 10

AUGUST, 1927

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(NOT FOR RELEASE)

## THE EFFECT OF CALCIUM CHLORIDE ON FEDERAL-AID PAVEMENTS \*

THE INFORMATION AVAILABLE, BOTH EXPERIMENTAL AS WELL AS THAT OBTAINED FROM THE USE OF CALCIUM CHLORIDE AS A CURING AGENT ON NUMEROUS FEDERAL-AID PROJECTS, DURING THE PAST SEVERAL YEARS, SEEMS TO WARRANT THE FOLLOWING GENERAL CONCLUSIONS.

### SURFACE CURING

THE PREPONDERANCE OF THE EVIDENCE SEEMS TO SHOW THAT THE USE OF CALCIUM CHLORIDE AS A SURFACE CURING AGENT MAY BE ASSOCIATED WITH SURFACE SCALING. THIS APPEARS TO BE DUE, IN GENERAL, TO THE DIFFICULTY OF SECURING A UNIFORM DISTRIBUTION OF THE MATERIAL ON THE SURFACE OF THE PAVEMENT WITH A CONSEQUENT TENDENCY TOWARD A CONCENTRATION OF THE SALT IN CERTAIN AREAS, RESULTING IN A SOFTENING AND SCALING OF THE SURFACE. FOR THIS REASON THE BUREAU HAS BEEN RELUCTANT TO APPROVE THE USE OF CALCIUM CHLORIDE AS A SURFACE CURING AGENT.

### INTEGRAL CURING

ALTHOUGH REPORTS FROM THE FIELD DO NOT APPEAR TO ASSOCIATE SURFACE SCALING WITH THE USE OF CALCIUM CHLORIDE AS AN INTEGRAL CURING AGENT, TO THE SAME EXTENT AS WHEN THE MATERIAL IS USED ON THE SURFACE; TESTS MADE BY THE BUREAU ON THE MARYLAND AND VIRGINIA EXPERIMENTAL ROADS INDICATE THAT THE STRENGTH OF CONCRETE, MADE WITH CALCIUM CHLORIDE AS AN ADMIXTURE, MAY BE SLIGHTLY LESS THAN THE STRENGTH OF SIMILAR CONCRETE WITHOUT THE ADMIXTURE. WHETHER THE REDUCTION IN STRENGTH, WHICH HAS BEEN NOTED IN THESE AS WELL AS OTHER TESTS, IS SUFFICIENT TO BE HARMFUL IS STILL A MOOT QUESTION; AND OPINION, GENERALLY, IS SO DIVIDED THAT IT IS BELIEVED ADVISABLE TO WITHHOLD FINAL JUDGMENT, PENDING THE FINDINGS FROM MORE EXTENSIVE STUDIES.



# STATES NOW USING CALCIUM CHLORIDE AS A CURING AGENT

AN INSPECTION OF AVAILABLE STATE HIGHWAY SPECIFICATIONS SHOWS THAT, AT THE PRESENT TIME, CALCIUM CHLORIDE IS PERMITTED WITHOUT RESTRICTION BY TWELVE STATES AS FOLLOWS:

## SURFACE CURING

ARKANSAS  
ILLINOIS  
KENTUCKY  
MINNESOTA  
MISSOURI  
TENNESSEE  
WISCONSIN

## INTEGRAL CURING

CONNECTICUT  
KENTUCKY  
NORTH CAROLINA  
NEW HAMPSHIRE  
SOUTH CAROLINA  
VERMONT

IN ADDITION TO THE ABOVE, THE FOLLOWING TEN ADDITIONAL STATES PERMIT THE USE OF CALCIUM CHLORIDE EITHER AS A SURFACE CURING AGENT OR AS AN ADMIXTURE, UNDER CERTAIN RESTRICTIONS, SUCH AS SPECIFIC APPROVAL BY THE ENGINEERS, ETC.

## SURFACE CURING

COLORADO  
KANSAS  
MISSISSIPPI  
NEBRASKA  
OHIO  
WEST VIRGINIA

## INTEGRAL CURING

ALABAMA  
DELAWARE  
IOWA  
MAINE

## REPORTS FROM DISTRICT OFFICES

IN RESPONSE TO A REQUEST FROM THE HEADQUARTERS OFFICE, THE DISTRICT ENGINEERS OF THE BUREAU HAVE RECENTLY SUBMITTED REPORTS ON THE CONDITION OF A NUMBER OF FEDERAL-AID PAVEMENTS CURED WITH CALCIUM CHLORIDE. THIS INFORMATION SHOWS THAT THE MATERIAL HAS BEEN USED ON 76 PROJECTS - ON 36 AS A SURFACE CURING AGENT AND ON 40 AS AN ADMIXTURE.

A TABULATION OF THE REPLIES FOR TWENTY-ONE STATES GIVES THE FOLLOWING RESULTS:

OPINION	SURFACE TREATMENT NUMBER OF PROJECTS	ADMIXTURE NUMBER OF PROJECTS
FAVORABLE	15	21
UNFAVORABLE	13	4
NON-COMMITTAL	<u>8</u>	<u>15</u>
	36	40





THE STATES COVERED BY THESE REPORTS - WHICH WERE ALL EAST OF THE ROCKY MOUNTAINS, WITH ONE EXCEPTION - WERE: ALABAMA, COLORADO, GEORGIA, ILLINOIS, IOWA, KANSAS, MARYLAND, MICHIGAN, MINNESOTA, MISSISSIPPI, MISSOURI, NEW HAMPSHIRE, NEW YORK, NORTH CAROLINA, OHIO, OKLAHOMA, PENNSYLVANIA, RHODE ISLAND, TENNESSEE, TEXAS, AND VERMONT.

THE REPORT ON EACH PROJECT WAS CLASSIFIED AS FAVORABLE OR UNFAVORABLE ON THE BASIS OF THE CONCLUSIONS REACHED BY THE ENGINEER MAKING THE REPORT - PROVIDED SUCH CONCLUSIONS SEEMED TO BE JUSTIFIED BY THE EVIDENCE PRESENTED. IN MANY CASES, DUE TO THE PRESENCE OF FACTORS WHICH TENDED TO OBSCURE THE REAL ISSUE IT WAS FOUND IMPOSSIBLE TO CLASSIFY REPORTS EITHER AS FAVORABLE OR UNFAVORABLE. IN SUCH CASES THE REPORTS WERE CLASSIFIED AS NON-COMMITTAL.

REFERENCE TO THE ABOVE TABLE INDICATES AT ONCE THAT OPINIONS AS TO THE RESULTS SECURED BY THE USE OF CALCIUM CHLORIDE AS A SURFACE CURING AGENT ARE ABOUT EQUALLY DIVIDED. A FURTHER STUDY OF THE REPORTS, HOWEVER, SHOWS THAT ON MANY OF THE PROJECTS REPORTING UNFAVORABLE RESULTS, AS MUCH AS 3 POUNDS PER SQUARE YARD WAS USED. THIS IS PARTICULARLY TRUE OF THE OLDER PROJECTS CONSTRUCTED WHEN THIS MATERIAL WAS FIRST COMING INTO USE. PRACTICALLY THE ONLY DELETERIOUS EFFECT ATTRIBUTED TO THE CURING AGENT IS SURFACE SCALING, AND THIS APPEARS TO BE MORE MARKED EITHER ON PROJECTS ON WHICH 3 POUNDS PER SQUARE YARD WAS SPECIFIED, OR ON PROJECTS WHERE THERE WAS EVIDENCE THAT THE SALT HAD BEEN UNEVENLY APPLIED. SUBSTANTIALLY THE SAME CONCLUSIONS WERE REACHED BY MR. CLIFFORD SHOEMAKER OF THE DIVISION OF CONSTRUCTION IN A REPORT, OF A FIELD INVESTIGATION OF SURFACE-CURED PAVEMENTS IN OHIO AND ILLINOIS, MADE DURING 1925. MR. SHOEMAKER'S REPORT CONCLUDES AS FOLLOWS:

1. AN EXCESSIVE AMOUNT OF CALCIUM CHLORIDE - MORE THAN 2-1/2 POUNDS PER SQUARE YARD - WILL CAUSE SCALING.
2. AN UNEVEN APPLICATION OF CALCIUM CHLORIDE - EVEN THOUGH THE AVERAGE AMOUNT BE LESS THAN 2-1/2 POUNDS PER SQUARE YARD - WILL CAUSE SCALING.
3. A CONCENTRATION OF THE CALCIUM-CHLORIDE LIQUID IN THE LOW SPOTS OF THE PAVEMENT, CAUSED BY THE UNEVEN SURFACE, WILL CAUSE SCALING IN THOSE AREAS.



THE SCALING OBSERVED BY MR. SHOEMAKER DURING HIS FIELD STUDIES RANGED IN DEPTH FROM .01-INCH TO .25-INCH IN EXTREME CASES. THE ORDINARY THICKNESS, HOWEVER, WAS ONE-EIGHTH OF AN INCH. THE REPORT ALSO CALLED ATTENTION TO THE FACT THAT SCALING WAS ALMOST UNKNOWN IN OHIO PRIOR TO THE INTRODUCTION OF CALCIUM CHLORIDE, AND THEN CONTINUED WITH A DESCRIPTION OF NUMEROUS OTHER POSSIBLE CAUSES FOR SCALING. FIGURE 1 SHOWS TYPICAL SCALED SURFACES OF CONCRETE PAVEMENTS CURED BY THE SURFACE TREATMENT WITH CALCIUM CHLORIDE, IN ILLINOIS AND COLORADO.

THE REPORTS FROM THE DISTRICT OFFICES INDICATE, IN GENERAL, THAT THE USE OF CALCIUM CHLORIDE AS AN ADMIXTURE, IN THE PROPORTION OF NOT TO EXCEED 2 PER CENT OF THE WEIGHT OF THE CEMENT, HAS PROVEN SATISFACTORY - AT LEAST INSOFAR AS MAY BE DETERMINED FROM VISUAL INSPECTION. THE SAME TENDENCY TO SCALE DOES NOT SEEM TO EXIST AS ON THE PAVEMENTS CURED BY A SURFACE APPLICATION OF THE MATERIAL. HOWEVER, IN CERTAIN CASES, A MARKED ACCELERATION OF THE SET WAS OBSERVED, MAKING IT NECESSARY TO CARRY ON THE FINISHING OPERATION IMMEDIATELY FOLLOWING THE DEPOSITING OF THE CONCRETE. ON ONE PROJECT, A TENDENCY OF THE CEMENT TO SET IN THE DRUM OF THE MIXER WAS REPORTED. EXPERIENCE, IN THOSE STATES WHERE THIS METHOD OF CURING HAS BEEN IN USE FOR SOME TIME, INDICATES THAT MOST OF THE MECHANICAL DIFFICULTIES MAY BE AVOIDED BY THE USE OF THE PROPER EQUIPMENT, AND AN ORGANIZATION EXPERIENCED IN THE USE OF THE MATERIAL.

STRENGTH DATA BEARING ON THE USE OF CALCIUM CHLORIDE AS AN ADMIXTURE ARE SOMEWHAT MEAGER. MANY TESTS, INCLUDING THOSE MADE BY THE BUREAU ON THE MARYLAND AND VIRGINIA EXPERIMENTAL ROADS INDICATE A SLIGHT DECREASE IN STRENGTH FOR THE CONCRETE IN WHICH CALCIUM CHLORIDE IS USED AS AN ADMIXTURE, AS COMPARED TO THE UNTREATED CONCRETE. THIS APPLIES TO STRENGTH TESTS MADE AT THE AGE OF 7 DAYS OR LATER AND NOT TO TESTS MADE AT ANY EARLY PERIODS. IN CONNECTION WITH THE MARYLAND EXPERIMENTS, TESTS MADE ON CONCRETE CYLINDERS AT PERIODS UP TO 4 DAYS OLD, INDICATE AN APPRECIABLY HIGHER STRENGTH FOR THE CONCRETE CONTAINING THE ADMIXTURE. AS NOTED ABOVE, THIS DIFFERENTIAL DISAPPEARS AT LATER PERIODS, THE NORMAL CONCRETE OVERTAKING AND SOMETIMES EVEN PASSING THE CALCIUM CHLORIDE CONCRETE.

WITH REFERENCE TO THE USE OF CALCIUM CHLORIDE AS AN ACCELERATOR, IT WOULD APPEAR UNWISE TO DEPEND UPON THIS EARLY HARDENING EFFECT TO THE EXTENT OF OPENING THE ROAD TO TRAFFIC SOONER





FIGURE 1-(TOP)- TYPICAL SCALING ON A CONCRETE PAVEMENT IN ILLINOIS, SURFACE TREATED WITH CALCIUM CHLORIDE.

(BOTTOM)- SCALING ON SECTIONS OF COLORADO FEDERAL AID PROJECT 878-A, SURFACE-TREATED WITH CALCIUM CHLORIDE.





THAN WOULD NORMALLY BE THE CASE UNLESS STRENGTH TESTS WERE MADE ON THE JOB FOR THE PURPOSE OF ASCERTAINING WHEN THE DESIGN STRENGTH HAD BEEN REACHED.

IN CONCLUSION, IT MAY BE SAID THAT INsofar AS SERVICE BEHAVIOR TO DATE IS CONCERNED, THE USE OF CALCIUM CHLORIDE AS AN ADMIXTURE, APPEARS TO BE SATISFACTORY. IN VIEW, HOWEVER, OF THE APPARENT TENDENCY OF CONCRETE IN WHICH THE MATERIAL IS USED TO SHOW SLIGHTLY LOWER STRENGTH THAN NORMAL CONCRETE, IT WOULD NOT SEEM WISE TO GIVE UNQUALIFIED APPROVAL TO THIS METHOD OF CURING, UNTIL FURTHER DATA ALONG THIS LINE HAVE BEEN OBTAINED.





UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF PUBLIC ROADS

F-1 (1926)  
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TOTAL INCOME AND FUNDS AVAILABLE, 1926  
FOR STATE ROAD AND BRIDGE WORK UNDER SUPERVISION OF THE STATE HIGHWAY DEPARTMENTS  
DURING FISCAL YEAR.

STATES	FISCAL YEAR END	TOTAL FUNDS AVAILABLE (100%)	BALANCE AT BEGINNING OF YEAR	% OF TOTAL FUNDS	TOTAL INCOME DURING YEAR	% OF TOTAL FUNDS	STATE HWY. BONDS, NOTES, ETC.	% OF TOTAL FUNDS	APPROPRIATION BY STATE FOR HIGHWAYS	% OF TOTAL FUNDS	MISCELLANEOUS STATE INCOME FOR HIGHWAYS	% OF TOTAL FUNDS	MOTOR VEHICLE FEES, ETC. FOR ROAD PURPOSES	% OF TOTAL FUNDS	GASOLINE TAX APPLICABLE TO HIGHWAYS	% OF TOTAL FUNDS	TRANSFERRED FUNDS FROM COUNTIES, ETC.	% OF TOTAL FUNDS	FEDERAL AID FOR POST ROAD FUNDS USED	% OF TOTAL FUNDS
ALASKA	9/30	\$ 12,186,642	\$ 2,519,745	20.6	\$ 9,665,897	79.4	\$ 5,627,954	46.2	-	-	-	-	\$ 2,247,268	18.5	-	-	-	-	\$ 1,619,280	13.2
ARIZONA (1)	6/30	2,399,554	244,286	10.1	2,154,268	91.9	-	-	9,250	0.4	-	-	452,662	18.8	449,983	18.7	-	-	558,251	23.3
ARKANSAS (1)	6/30	10,406,312	847,501	8.2	9,558,811	91.8	-	-	-	-	-	-	3,526,577	33.9	4,017,175	38.6	307,000	2.9	1,709,059	16.4
CALIFORNIA	12/31	25,324,939	2,535,048	10.0	20,089,891	79.4	-	-	4,889,518	19.3	-	-	3,594,433	14.2	9,027,580	31.7	302,538	1.2	3,275,832	13.2
COLORADO	11/30	7,559,043	1,452,481	19.2	6,106,562	80.8	2,101,991	28.7	3,166,500	16.9	-	-	1,391,322	12.5	1,043,187	12.2	63,314	0.8	1,136,043	15.4
CONNECTICUT	6/30	18,789,366	5,951,326	30.1	13,128,040	69.9	1,107,835	27.2	-	-	-	-	6,715,965	19.0	3,965,656	9.8	1,065,610	26.1	2,401,337	24.0
DELAWARE	6/30	1,616,166	247,151	15.3	1,369,015	84.7	-	-	-	-	-	-	210,842	12.4	8,536,359	47.2	1,615,138	33.3	1,041,863	65.0
FLORIDA	12/31	18,334,953	2,427,151	13.2	15,905,912	86.8	-	-	-	-	-	-	330,594	3.1	2,328,574	22.0	852,094	8.0	2,571,705	24.3
GEORGIA	12/31	10,532,171	1,228,655	11.6	9,303,515	88.4	-	-	-	-	-	-	142,137	3.4	1,182,584	22.0	947,302	22.3	1,399,098	23.1
IDAHOO	12/31	4,231,525	4,231,525	100.0	4,011,595	94.9	-	-	-	-	-	-	13,337,580	63.6	-	-	-	-	2,036,922	7.8
ILLINOIS	12/31	26,978,131	4,836,199	18.7	21,141,932	81.3	4,953,100	19.1	-	-	-	-	5,305,537	24.6	5,753,374	27.5	18,314	0.3	2,439,728	16.3
INDIANA	9/30	15,349,735	1,361,613	8.9	13,988,122	91.1	-	-	-	-	-	-	238,514	1.1	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
IOWA	11/30	21,283,182	3,780,912	17.8	17,502,270	82.2	-	-	135,000	0.9	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
KANSAS	6/30	1,616,166	247,151	15.3	1,369,015	84.7	-	-	-	-	-	-	210,842	12.4	8,536,359	47.2	1,615,138	33.3	1,041,863	65.0
KENTUCKY	6/30	7,889,359	1,452,481	18.4	6,436,878	81.6	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
LOUISIANA	12/31	10,715,310	1,350,316	12.6	9,364,994	87.4	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MAINE	12/31	11,841,722	1,379,316	11.7	10,462,404	88.3	2,676,054	22.6	300,000	2.5	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MARYLAND	9/30	12,524,294	1,723,471	13.7	10,800,823	86.3	1,863,533	14.9	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MASSACHUSETTS	11/30	17,511,597	1,748,896	10.0	15,762,701	90.0	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MICHIGAN	6/30	29,773,273	2,555,718	8.5	27,217,555	91.5	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MINNESOTA	12/31	24,997,171	4,530,311	18.2	20,466,860	82.0	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MISSISSIPPI	6/30	1,616,166	247,151	15.3	1,369,015	84.7	-	-	-	-	-	-	210,842	12.4	8,536,359	47.2	1,615,138	33.3	1,041,863	65.0
MISSOURI	12/31	37,902,725	4,272,454	11.3	33,630,261	88.7	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
MONTANA	6/30	1,291,405	138,704	10.9	1,152,702	89.1	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEBRASKA	12/31	10,039,439	3,400,346	33.8	6,639,093	66.2	-	-	100,000	1.0	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEVADA	11/30	2,069,553	65,798	3.3	2,003,755	96.7	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEW HAMPSHIRE	12/31	4,147,032	1,366,250	32.9	2,780,782	67.1	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEW JERSEY	12/31	32,395,324	8,432,518	26.1	23,962,816	74.3	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEW MEXICO (1)	6/30	91,255,226	26,875,853	29.6	64,379,373	70.4	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NEW YORK	12/31	1,616,166	247,151	15.3	1,369,015	84.7	-	-	-	-	-	-	210,842	12.4	8,536,359	47.2	1,615,138	33.3	1,041,863	65.0
NORTH CAROLINA	6/30	50,157,925	2,480,809	4.9	47,677,116	95.1	15,174,980	30.2	2,584	0.01	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
NORTH DAKOTA	6/30	2,776,988	167,572	6.1	2,609,416	93.9	-	-	350,000	12.6	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
OHIO	12/31	30,483,268	5,258,583	17.3	25,224,685	82.7	-	-	2,024,435	6.6	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
OKLAHOMA	12/31	12,937,707	2,195,412	16.9	10,742,295	82.7	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
OREGON (1)	11/30	10,888,900	1,452,481	13.3	9,436,419	86.7	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
PENNSYLVANIA	12/31	75,894,373	11,978,273	15.8	63,916,100	84.2	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
RHODE ISLAND	6/30	1,616,166	247,151	15.3	1,369,015	84.7	-	-	-	-	-	-	210,842	12.4	8,536,359	47.2	1,615,138	33.3	1,041,863	65.0
SOUTH CAROLINA	12/31	9,893,205	150,236	1.5	9,742,969	98.5	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
SOUTH DAKOTA	12/31	6,590,341	1,008,123	15.3	5,582,218	84.7	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
TENNESSEE (1)	6/30	14,970,216	1,774,494	11.8	13,195,722	88.2	500,000	3.3	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
TEXAS	12/31	20,012,951	91,076	0.5	19,921,875	99.5	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
UTAH	12/31	2,672,002	86,474	3.2	2,585,528	96.8	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
VERMONT (1)	2/1	4,052,955	542,417	13.4	3,510,538	86.6	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
VIRGINIA	12/31	18,255,285	152,522	0.8	18,102,763	99.2	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
WASHINGTON	12/31	24,095,970	7,418,657	30.8	16,677,313	69.2	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
WEST VIRGINIA	12/31	24,095,970	1,854,215	7.7	22,241,755	92.3	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
WISCONSIN	6/30	3,023,533	144,820	4.8	2,878,713	95.2	-	-	-	-	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
WYOMING	12/31	805,587,608	138,283,304	16.6	677,304,304	84.4	103,846,301	12.9	29,868,048	3.7	-	-	3,317,428	22.6	4,716,000	10.1	1,500,000	10.1	1,748,272	11.3
TOTALS																				

REMARKS: ABOVE FUNDS GENERALLY APPLICABLE TO STATE HIGHWAY FINANCING.

- NOTES: (1) IN EIGHT STATES THE FISCAL YEAR ENDING HAS BEEN CHANGED FROM THAT OF 1925  
(2) COUNTY BONDS ISSUED AS STATE OBLIGATIONS  
(3) INVESTED BY TREASURER FOR BOND SINKING FUNDS.



UNITED STATES DEPARTMENT OF AGRICULTURE  
Bureau of Public Roads

TOTAL DISBURSEMENTS, 1926.

FOR STATE ROAD AND BRIDGE WORK UNDER SUPERVISION OF THE STATE HIGHWAY DEPARTMENTS  
INCLUDING STATE BOND PAYMENTS, DURING FISCAL YEARS OF - 1926.

F-2 (1926)  
B A

STATES	FISCAL YEAR ENDS	TOTAL DISBURSEMENTS DURING YEAR (1000)	CONSTRUCTION ON ROADS & BRIDGES	% OF TOTAL DISBURSEMENTS ON ROADS & BRIDGES	MAINTENANCE ON ROADS & BRIDGES	% OF TOTAL DISBURSEMENTS ON ROADS & BRIDGES	MISCELLANEOUS EXPENSES (2)	% OF TOTAL DISBURSEMENTS	BONDS, NOTES, ETC. PAID ON PRINCIPAL	% OF TOTAL DISBURSEMENTS	BONDS, NOTES, ETC. PAID ON INTEREST	% OF TOTAL DISBURSEMENTS	EQUIPMENT, MATERIALS	% OF TOTAL DISBURSEMENTS	A-COUNTY FINANCING B-RIGHT-OF-WAY C-TRAFFIC, ETC.	% OF TOTAL DISBURSEMENTS	UNEXPENDED BALANCE AT THE END OF YEAR
ALABAMA	9/30	\$ 10,230,349	6,853,846	66.6	417,662	4.1	813,665	7.9	868,224	8.4	798,610	7.8	639,353	6.2	A 7,500	-	1,896,593
ARIZONA (1)	6/30	2,565,502	1,342,114	52.3	923,170	36.0	184,932	6.4	-	-	-	-	127,486	6.0	A 3,000,000	0.3	- (166,848)
ARKANSAS (1)	6/30	9,562,657	3,785,200	39.6	1,093,484	11.4	303,132	3.2	1,775,000	8.6	3,114,617	14.7	335,728	1.4	C 289,013	1.3	4,223,610
CALIFORNIA	12/31	31,095,329	9,895,370	46.9	4,295,435	20.3	1,419,285	6.7	630,214	-	411,107	-	24,913	0.4	C 6,046	0.1	1,728,610
COLORADO	11/30	5,850,313	3,513,568	60.1	786,684	14.4	481,861	8.8	244,500	7.0	400,420	11.5	30,418	0.9	BC 134,484	3.9	8,606,351
CONNECTICUT	12/31	13,459,191	3,350,433	24.9	6,120,620	53.9	104,454	4.2	-	-	-	-	213,712	1.6	BC 134,484	3.9	4,627,049
DELAWARE	12/31	1,459,191	10,725,901	78.6	1,863,441	13.6	843,980	6.2	244,500	7.0	400,420	11.5	30,418	0.9	BC 134,484	3.9	8,606,351
FLORIDA	12/31	13,657,014	10,725,901	78.6	1,863,441	13.6	843,980	6.2	244,500	7.0	400,420	11.5	30,418	0.9	BC 134,484	3.9	4,627,049
GEORGIA	12/31	9,564,829	6,694,894	70.0	1,520,801	15.9	965,639	10.0	-	-	-	-	335,319	3.6	AC 58,156	0.6	1,027,422
IDAH0	12/31	4,190,725	2,694,286	64.3	634,671	12.7	384,070	8.7	29,500	0.7	163,399	3.9	422,131	10.1	AC 82,798	2.0	40,800
ILLINOIS	12/31	24,267,209	14,007,453	57.7	1,531,442	6.3	2,388,147	9.8	2,000,000	8.2	3,510,843	14.4	330,113	1.3	AC 499,201	2.0	1,710,322
INDIANA	9/30	12,428,784	8,493,981	68.3	2,301,005	18.5	609,077	4.9	-	-	-	-	894,443	7.2	B 131,278	1.1	2,350,951
IOWA	11/30	15,272,455	8,056,757	53.1	2,603,053	24.0	765,639	6.0	(3) 1,986,490	13.0	(3) 170,228	-	-	-	B 680,278	3.8	6,020,727
KANSAS	12/31	9,171,240	6,120,620	66.6	2,000,000	21.8	460,868	4.9	-	-	480,169	4.9	204,703	2.1	A 400,520	1.1	5,626,625
KENTUCKY	12/31	10,597,544	7,320,229	69.1	2,620,396	24.8	440,098	7.6	29,000	0.3	26,425	0.2	290,573	2.8	C 120,282	1.1	0 (-2,152,552)
LOUISIANA	12/31	10,597,544	7,320,229	69.1	2,620,396	24.8	440,098	7.6	29,000	0.3	26,425	0.2	290,573	2.8	C 120,282	1.1	0 (-2,152,552)
MAINE	12/31	10,597,544	7,320,229	69.1	2,620,396	24.8	440,098	7.6	29,000	0.3	26,425	0.2	290,573	2.8	C 120,282	1.1	0 (-2,152,552)
MARYLAND	9/30	10,597,544	7,320,229	69.1	2,620,396	24.8	440,098	7.6	29,000	0.3	26,425	0.2	290,573	2.8	C 120,282	1.1	0 (-2,152,552)
MASSACHUSETTS	11/30	13,794,244	3,650,435	26.5	3,962,949	28.8	1,244,515	9.0	2,002,640	18.9	990,830	9.3	142,109	1.0	A 2,489,637	18.1	1,986,750
MICHIGAN	6/30	25,997,517	11,291,331	43.4	1,999,616	14.6	1,244,515	9.0	521,000	3.8	207,914	1.5	1,578,832	6.1	AB 3,259,356	12.5	3,775,353
MINNESOTA	12/31	17,378,982	10,171,242	58.6	2,891,468	16.1	1,300,013	0.7	(3) 159,088	0.9	(3) 1,597,109	8.9	2,523,945	14.6	AB 406,087	2.3	6,828,609
MISSISSIPPI	12/31	4,697,573	2,827,642	60.2	1,618,432	34.5	151,029	3.2	2,005,060	6.5	1,646,875	5.3	53,708	1.1	A 46,652	1.0	7,161,732
MISSOURI	12/31	30,161,507	23,650,002	78.4	1,914,144	6.2	1,685,226	5.6	-	-	-	-	6,076	0.5	A 9,416	0.8	7,161,732
NEBRASKA (1)	12/31	7,639,284	5,535,612	72.6	1,592,322	20.8	186,361	2.4	-	-	-	-	204,680	2.7	BC 48,454	0.6	2,400,166
NEVADA	12/31	1,698,875	982,420	57.8	282,209	16.6	186,361	11.0	100,000	6.9	31,750	1.9	59,774	2.0	AC 29,814	1.7	1,370,477
NEW HAMPSHIRE	12/31	3,015,992	1,189,848	39.5	1,319,710	43.7	2,659,482	11.0	-	-	-	-	51,325	0.2	AB 5,568,586	23.3	1,370,477
NEW JERSEY	12/31	24,377,507	12,103,331	49.8	929,669	31.7	133,509	4.6	1,374,440	-	891,500	3.7	31,718	0.6	A 5,122,170	12.3	9,977,827
NEW MEXICO	6/30	2,928,454	1,599,537	54.7	399,669	13.7	2,577,555	6.2	20,000	0.7	113,600	3.8	131,718	4.6	A 1,122,170	12.3	365,774
NEW YORK	12/31	41,791,030	21,107,388	50.5	7,955,938	19.0	2,577,555	6.2	400,000	1.0	4,240,000	10.1	377,979	0.9	A 5,122,170	12.3	49,981,171
NORTH CAROLINA	6/30	37,616,148	21,424,969	57.6	4,630,448	12.5	2,173,083	5.8	400	-	3,402,171	9.1	4,899,452	13.2	A 686,625	1.8	12,951,716
NORTH DAKOTA	6/30	3,917,868	1,325,231	33.8	1,417,125	36.1	79,680	2.0	-	-	-	-	32,111	0.8	A 686,625	1.8	987,460
OHIO	12/31	10,419,979	7,984,944	76.7	1,768,869	17.0	659,575	6.3	-	-	-	-	165,775	1.6	-	-	2,611,728
OKLAHOMA	11/30	10,419,979	7,984,944	76.7	1,768,869	17.0	659,575	6.3	-	-	-	-	165,775	1.6	-	-	2,611,728
OREGON	12/31	10,419,979	7,984,944	76.7	1,768,869	17.0	659,575	6.3	-	-	-	-	165,775	1.6	-	-	2,611,728
PENNSYLVANIA	12/31	50,912,638	(5) 26,417,008	51.9	13,237,691	26.9	283,410	6.8	1,197,000	2.2	1,722,762	17.2	651,724	1.3	AC 2,462,408	4.8	24,981,699
RHODE ISLAND	11/30	3,870,559	1,505,669	38.9	1,284,343	33.3	283,410	6.8	-	-	-	-	651,724	1.3	AC 2,462,408	4.8	24,981,699
SOUTH CAROLINA	12/31	9,640,281	6,287,302	65.3	1,170,371	11.9	346,821	3.6	-	-	296,292	6.1	21,604	0.4	C 331,321	3.4	652,924
SOUTH DAKOTA	12/31	5,843,422	3,240,828	55.6	1,174,034	20.1	653,523	11.2	450,000	7.7	-	-	3,040,072	21.7	C 331,321	3.4	282,924
TENNESSEE (1)	6/30	19,689,205	7,656,816	39.0	8,560,217	43.5	1,247,324	6.3	-	-	24,000	0.2	3,040,072	21.7	-	-	333,501
TEXAS	12/31	19,689,205	7,656,816	39.0	8,560,217	43.5	1,247,324	6.3	-	-	24,000	0.2	3,040,072	21.7	-	-	333,501
UTAH	12/31	19,689,205	7,656,816	39.0	8,560,217	43.5	1,247,324	6.3	-	-	24,000	0.2	3,040,072	21.7	-	-	333,501
VERMONT (1)	6/30	3,713,177	2,050,281	55.2	1,417,044	38.2	575,285	4.8	-	-	-	-	124,119	3.3	-	-	323,947
VIRGINIA	12/31	12,013,755	7,028,589	58.5	2,816,439	23.5	575,285	4.8	-	-	-	-	124,119	3.3	-	-	323,947
WASHINGTON	12/31	8,825,455	5,865,034	66.6	2,037,910	23.1	659,383	7.8	2,000,000	11.4	1,883,060	10.8	-	-	AC 1,655,710	15.4	6,604,714
WEST VIRGINIA	12/31	17,492,265	11,020,414	63.1	2,037,910	23.1	659,383	7.8	2,000,000	11.4	1,883,060	10.8	-	-	AC 1,655,710	15.4	4,360,934
WISCONSIN	6/30	12,130,946	6,456,409	53.3	3,368,967	27.7	333,174	3.6	500,000	16.8	116,700	3.9	78,616	1.6	-	-	49,537
WYOMING	12/31	2,973,886	1,502,512	60.5	641,383	21.6	165,785	5.6	-	-	-	-	-	-	-	-	-
TOTALS		621,744,210	351,222,337	56.5	126,617,313	20.2	37,176,589	6.0	21,879,325	3.5	33,690,051	5.4	22,284,756	3.6	29,873,639	4.8	187,431,736
																	-2,481,338
																	184,945,398

REMARKS: THE DISBURSEMENTS REPORTED ABOVE, IN GENERAL, COVER MONEY SPENT ON STATE HIGHWAYS.

- NOTES:
- (1) IN 8 STATES THE ENDING OF FISCAL YEAR HAS BEEN CHANGED FROM THAT OF 1925
  - (2) INCLUDES ADMINISTRATION AND ENGINEERING FORMERLY REPORTED SEPARATELY
  - (3) PAYMENTS ON COUNTY BOND OBLIGATIONS ASSIGNED BY STATE
  - (4) INTEREST ON ROAD WARRANT NOTES
  - (5) INCLUDES \$1,279,585 ON STATE HIGHWAYS FINANCED BY COUNTIES





United States Department of Agriculture  
Bureau of Public Roads

DIVISION OF CONTROL.  
GASOLINE TAX RATES, BY STATES

As of August 1, 1927

Showing Present Tax Rate Per Gallon and the Dates Rates Were Effective

Tax Rate	States	Date Effective		Tax Rate	States	Date Effective
Cents				Cents		
5	Arkansas	6/9/27		3	Montana	1/1/27
	Florida	7/1/27			New Hampshire	5/1/27
	Kentucky	2/21/26			Ohio	5/11/27
	New Mexico	3/7/27			Oklahoma	3/23/25
	South Carolina	3/23/25			Oregon	5/24/23
4½	Virginia	3/10/26			Pennsylvania	7/1/27
4	Alabama	1/4/27			Tennessee	2/9/25
	Idaho	2/28/27			Texas	3/16/27
	Maryland	4/1/27			Vermont	7/1/27
	Mississippi	4/1/26		2	Wyoming	4/1/25
	Nevada	4/1/25			Connecticut	7/1/25
	North Carolina	2/21/25			Illinois	8/1/27
	South Dakota	7/1/27			Kansas	5/1/25
	West Virginia	7/1/27			Louisiana	8/1/24
3½	Georgia	8/26/25			Minnesota	5/1/25
	Utah	4/1/25			Missouri	1/1/25
3	Arizona	6/9/23			Nebraska	4/1/25
	California	7/29/27			New Jersey	7/1/27
	Colorado	5/1/27			North Dakota	7/30/26
	Delaware	3/24/27			Rhode Island	6/1/27
	Indiana	4/1/25			Washington	1/1/24
	Iowa	7/4/27			Wisconsin	4/1/25
	Michigan	9/4/27		No	District of	
	Maine*	7/11/25		Tax	Columbia	5/23/24
					Massachusetts	
					New York	
					Hawaii	

\* Due to a petition submitted to the Secretary of State the four cent gas tax law did not become effective on July 16, 1927  
The tax rate will continue to be three cents.



DIGEST OF RECENT DECISIONS OF THE U. S. SUPREME COURT  
RELATIVE TO INTERSTATE MOTOR VEHICLE TRAFFIC

(THIS BRIEF COVERS THE FIRST THREE OF A SERIES OF SEVEN RECENT DECISIONS OF THE UNITED STATES SUPREME COURT. THE REST OF THE RULINGS WILL BE PUBLISHED IN THE NEXT ISSUE OF THE NEWS LETTER.)

THE DUKE CARTAGE COMPANY, AT THE TIME OF THE PASSAGE OF THE STATE ACT (ACT NO. 209, PUBLIC ACTS OF 1923 OF MICHIGAN), CONCERNING TRANSPORTATION FOR HIRE BY MOTOR VEHICLES, HAD THREE CONTRACTS TO TRANSPORT FROM DETROIT, MICH., TO TOLEDO, OHIO, AUTOMOBILE BODIES MADE AT THE PLANTS OF THREE MANUFACTURERS IN DETROIT AND INTENDED FOR THE USE OF AN AUTOMOBILE MANUFACTURER AT TOLEDO. THEY HAD BEEN DOING SUCH HAULING FOR SOME YEARS, AND HAD A LARGE INVESTMENT IN PROPERTY USED EXCLUSIVELY FOR THAT PURPOSE. THEY OPERATED UPON THE PUBLIC HIGHWAYS OF MICHIGAN, WHICH FORMED A PART OF THE ROUTE BETWEEN DETROIT AND TOLEDO. THEY WERE ENGAGED SOLELY IN INTERSTATE HAULING. THEY HAD NO OTHER BUSINESS AND DID NOT HOLD THEMSELVES OUT AS A PUBLIC CARRIER.

IN 1923, THE STATE OF MICHIGAN PASSED AN ACT (ACT NO. 209, PUBLIC ACTS OF 1923 OF MICHIGAN) WHICH PROVIDED AMONG OTHER THINGS THAT ALL PERSONS ENGAGED IN THE TRANSPORTATION OF PERSONS OR PROPERTY FOR HIRE BY MOTOR VEHICLE OVER THE PUBLIC HIGHWAYS OF THE STATE SHALL BE COMMON CARRIERS AND SUBJECT TO EXISTING LAWS RELATIVE TO SUCH AGENTS. THE ACT FURTHER PROVIDED THAT THE MOTOR VEHICLE COMMON CARRIER MUST CARRY LIABILITY INSURANCE FOR THE PROTECTION OF PROPERTY AND PERSONS FROM INJURY. A RULE ADOPTED BY THE STATE PUBLIC SERVICE COMMISSION REQUIRED ALL COMMON CARRIERS TO PROVIDE AN INDEMNITY BOND IN AN APPROVED AMOUNT, PRIOR TO GRANTING A PERMIT TO OPERATE. THE ACT FURTHER PROVIDED FOR A FEE TO BE PAID BY ALL COMMON CARRIERS AND PROVIDED ALSO THAT THIS FEE SHALL BE APPROPRIATED TO THE GENERAL HIGHWAY FUND. IT FURTHER PROVIDED PENALTIES FOR VIOLATIONS OF THE ACT OR RULINGS OF THE COMMISSION.

WHEN THE DUKE CARTAGE COMPANY REFUSED TO RECOGNIZE THE VALIDITY OF THE ACT AND NEGLECTED TO MAKE ANY APPLICATION FOR A PERMIT, THE STATE POLICE AND LOCAL OFFICERS INTENDED TO PROHIBIT THEIR USE OF THE HIGHWAYS. THE CASE WAS BROUGHT INTO COURT WHEN THE COMPANY SOUGHT AN INJUNCTION TO PREVENT THE STATE FROM PROHIBITING THEM FROM THE USE OF THE ROAD. DUKE ALLEGED THAT





THE ENFORCEMENT OF THE ACT WOULD CAUSE HIS COMPANY IRREPARABLE INJURY, THE LOSS OF THEIR CONTRACTS, THE DESTRUCTION OF THEIR BUSINESS, AND THE LOSS OF A SUBSTANTIAL PART OF THEIR CAPITAL INVESTMENT. HE ASSAILED THE ACT AS INVALID; AND, AMONG OTHER THINGS, AVERRED THAT IT CONTRAVENED THE COMMERCE CLAUSE OF THE CONSTITUTION OF THE UNITED STATES; THAT IT IS REPUGNANT TO THE DUE PROCESS CLAUSE OF THE FOURTEENTH AMENDMENT, AND THAT IT VIOLATES THE CONSTITUTION OF MICHIGAN, BECAUSE IT CONTAINS A PLURALITY OF OBJECTS, AND ITS REAL OBJECT IS NOT EXPRESSED IN THE TITLE.

THE LOWER COURT GRANTED THE INJUNCTION TO THE DUKE CARTAGE COMPANY ON THE GROUNDS THAT THE INDEMNITY BONDS REQUIRED BY THE ACT IMPOSED A DIRECT BURDEN ON INTERSTATE COMMERCE AND THAT PRIVATE CARRIERS COULD NOT BE CLASSED AS COMMON CARRIERS BECAUSE SUCH AN INTERPRETATION WAS FOREIGN TO THE TITLE OF THE ACT.

THE CASE WAS THEREUPON APPEALED TO THE SUPREME COURT OF THE UNITED STATES. THIS TRIBUNAL HELD THAT THE DUKE CARTAGE COMPANY WAS A PRIVATE CARRIER AND AFFIRMED THE DECREE OF THE LOWER COURT. THE DECISION WAS BASED UPON THE FOLLOWING REASONING: THE SOLE BUSINESS OF THE DUKE CARTAGE COMPANY WAS INTERSTATE COMMERCE, AND IT WAS LIMITED TO THE TRANSPORTATION COVERED BY THEIR THREE CONTRACTS. THEY HAD NO POWER OF EMINENT DOMAIN OR FRANCHISE UNDER THE STATE, AND NO GREATER RIGHT TO USE THE HIGHWAYS THAN ANYONE ELSE. THEY DID NOT UNDERTAKE TO CARRY FOR THE PUBLIC, AND DID NOT DEVOTE THEIR PROPERTY TO ANY PUBLIC USE. THE PUBLIC WAS NOT DEPENDENT ON THEM OR THE USE OF THEIR PROPERTY FOR SERVICE, AND HAD NO RIGHT TO CALL ON THEM FOR TRANSPORTATION. THE STATE ACT LEFT IT TO THE COMMISSION TO REQUIRE THE DUKE CARTAGE COMPANY, IF THEY WERE TO USE THE HIGHWAYS, TO BE PREPARED TO FURNISH ADEQUATE SERVICE TO THE PUBLIC. IT WOULD MAKE THEM COMMON CARRIERS AND SUBJECT THEM TO ALL THE BURDENS OF THAT BUSINESS, AND WOULD REQUIRE THEM TO FURNISH BOND FOR THE PROTECTION OF THOSE FOR WHOM THEY HAUL.

THE SUPREME COURT HAD PREVIOUSLY HELD THAT A STATE MAY RIGHTFULLY PRESCRIBE UNIFORM REGULATIONS NECESSARY FOR THE PUBLIC SAFETY AND ORDER IN RESPECT TO THE OPERATION OF ALL MOTOR VEHICLES UPON ITS HIGHWAYS - THOSE MOVING IN INTERSTATE COMMERCE AS WELL AS OTHERS. THEY HAD ALSO HELD THAT A REASONABLE GRADUATED LICENSE FEE IMPOSED BY THE STATE ON MOTOR VEHICLES USED IN INTERSTATE COMMERCE DOES NOT CONSTITUTE A DIRECT BURDEN ON INTERSTATE COMMERCE (HENDRICK V. MARYLAND, 235 U. S. 610, 622; KANE V. NEW JERSEY, 242 U. S. 160, 167). SUCH REGULATIONS WERE DEEMED REASONABLE AND AFFECT INTERSTATE COMMERCE ONLY INCIDENTALLY AND INDIRECTLY. BUT



THE SUPREME COURT HELD THAT THE STATE HAD NOT POWER TO IMPOSE UNREASONABLE REGULATIONS AND THEY HAD NO RIGHT TO MAKE THE DUKE CARTAGE COMPANY ACT AS A COMMON CARRIER BECAUSE THIS WOULD TAKE AWAY FROM THEM THE USE OF THE INSTRUMENTALITIES BY WHICH THEY CARRIED ON INTERSTATE COMMERCE AND SO WOULD DIRECTLY BURDEN AND INTERFERE WITH IT. THE COURT FURTHER HELD THAT IT WAS A BURDEN ON INTERSTATE COMMERCE TO COMPEL THE DUKE CARTAGE COMPANY TO FURNISH AN INDEMNITY BOND, SINCE CLEARLY THIS REQUIREMENT HAD NO RELATION TO PUBLIC SAFETY OR ORDER IN THE USE OF MOTOR VEHICLES UPON THE HIGHWAYS, OR TO THE COLLECTION OR COMPENSATION FOR THE USE OF THE HIGHWAYS. THE POLICE POWER DID NOT EXTEND SO FAR. IT WAS HELD, THEREFORE, THAT, IF APPLIED TO THE BUSINESS OF THE DUKE CARTAGE COMPANY, THE ACT WOULD VIOLATE THE COMMERCE CLAUSE OF THE CONSTITUTION.

MOREOVER, IT IS BEYOND THE POWER OF A STATE BY LEGISLATIVE FIAT TO CONVERT PROPERTY USED EXCLUSIVELY FOR THE PURPOSES OF A PRIVATE CARRIER INTO A PUBLIC UTILITY, OR TO MAKE THE OWNER A PUBLIC CARRIER, FOR THAT WOULD BE TAKING PRIVATE PROPERTY FOR PUBLIC USE WITHOUT JUST COMPENSATION, WHICH NO STATE CAN DO CONSISTENTLY WITH THE DUE PROCESS OF LAW CLAUSE OF THE FOURTEENTH AMENDMENT.

BASED UPON THIS REASONING, THEREFORE, THE DECREE OF THE LOWER COURT WAS AFFIRMED SINCE THE SUPREME COURT HELD THAT THE ENFORCEMENT OF THE ACT WOULD DEPRIVE THE DUKE CARTAGE COMPANY OF THEIR RIGHTS UNDER THE FEDERAL CONSTITUTION. THE SUPREME COURT OF MICHIGAN HAD NOT DECIDED WHETHER THE ACT CONTRAVENED THE STATE CONSTITUTION. THE UNITED STATES SUPREME COURT, THEREFORE, AFFIRMED THE DECREE ON THE GROUND THAT THE ENFORCEMENT OF THE ACT AGAINST DUKE WOULD DEPRIVE HIM OF HIS RIGHTS UNDER THE FEDERAL CONSTITUTION.

A. J. BUCK, A CITIZEN OF WASHINGTON, WISHED TO OPERATE AN AUTO STAGE LINE OVER THE PACIFIC HIGHWAY BETWEEN SEATTLE, WASH., AND PORTLAND, ORE., AS A COMMON CARRIER FOR HIRE EXCLUSIVELY FOR THROUGH INTERSTATE PASSENGERS AND EXPRESS. HE OBTAINED FROM OREGON THE LICENSE PRESCRIBED BY ITS LAWS. HAVING COMPLIED WITH THE LAWS OF WASHINGTON RELATING TO MOTOR VEHICLES, THEIR OWNERS AND DRIVERS, AND ALLEGING WILLINGNESS TO COMPLY WITH ALL APPLICABLE REGULATIONS CONCERNING COMMON





CARRIERS, BUCK THEN APPLIED FOR THE PRESCRIBED CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY. IT WAS REFUSED ON THE GROUND THAT, UNDER THE LAWS OF THE STATE, A CERTIFICATE MAY NOT BE GRANTED FOR ANY TERRITORY WHICH IS BEING ADEQUATELY SERVED BY THE HOLDER OF A CERTIFICATE; AND THAT, IN ADDITION TO FREQUENT STEAM RAILROAD SERVICE, ADEQUATE TRANSPORTATION FACILITIES BETWEEN SEATTLE AND PORTLAND WERE ALREADY BEING PROVIDED BY MEANS OF FOUR CONNECTING AUTO STAGE LINES, ALL OF WHICH HELD SUCH CERTIFICATES FROM THE STATE OF WASHINGTON (RE BUCK, P.U.R. 1923 E, 737).

TO ENJOIN INTERFERENCE BY THE OFFICIALS OF THE STATE WITH THE OPERATION OF THE PROJECTED LINE, BUCK BROUGHT SUIT AGAINST KUYKENDALL, THE DIRECTOR OF PUBLIC WORKS. THE INJUNCTION WAS REFUSED IN THE LOWER COURTS ON THE FOLLOWING GROUNDS: BUCK CLAIMED THAT THE ACTION OF THE STATE OFFICIALS VIOLATED RIGHTS CONFERRED BY THE FEDERAL-AID ROAD LEGISLATION AND GUARANTEED BOTH BY THE FOURTEENTH AMENDMENT AND THE COMMERCE CLAUSE, SINCE PORTIONS OF THE PACIFIC HIGHWAY IN WASHINGTON WERE BUILT WITH FEDERAL-AID FUNDS.

THE STATE ATTORNEYS AGREED THAT THE RIGHT OF INTERSTATE MOTOR VEHICLE TRAVEL UPON THE PUBLIC HIGHWAYS MAY BE A PRIVILEGE OR IMMUNITY OF CITIZENS OF THE UNITED STATES; AND A CITIZEN MAY HAVE, UNDER THE FOURTEENTH AMENDMENT, THE RIGHT TO TRAVEL AND TRANSPORT HIS PROPERTY UPON THEM BY AUTO VEHICLE, BUT HE HAS NO RIGHT TO MAKE THE HIGHWAYS HIS PLACE OF BUSINESS BY USING THEM AS A COMMON CARRIER FOR HIRE. SUCH USE IS A PRIVILEGE WHICH MAY BE GRANTED OR WITHHELD BY THE STATE IN ITS DISCRETION, WITHOUT VIOLATING EITHER THE DUE PROCESS CLAUSE OR THE EQUAL PROTECTION CLAUSE. THE ATTORNEYS FURTHER ARGUED THAT THE HIGHWAYS BELONGED TO THE STATE AND THAT IT MIGHT MAKE APPROPRIATE PROVISION FOR SECURING THE SAFETY AND CONVENIENCE OF THE PUBLIC IN THE USE OF THEM. IT MAY IMPOSE FEES WITH A VIEW BOTH TO RAISING FUNDS TO DEFRAY THE COST OF SUPERVISION AND MAINTENANCE AND TO OBTAINING COMPENSATION FOR THE USE OF THE ROAD FACILITIES PROVIDED. WITH THE INCREASE IN NUMBER AND SIZE OF THE VEHICLES USED UPON A HIGHWAY, BOTH THE DANGER AND THE WEAR AND TEAR GROW. TO EXCLUDE UNNECESSARY VEHICLES - PARTICULARLY THE LARGE ONES COMMONLY USED BY CARRIERS FOR HIRE - PROMOTES BOTH SAFETY AND ECONOMY. STATE REGULATION OF THAT CHARACTER IS VALID EVEN AS APPLIED TO INTER-STATE COMMERCE, IN THE ABSENCE OF LEGISLATION BY CONGRESS WHICH DEALS SPECIFICALLY WITH THE SUBJECT. NEITHER THE RECENT FEDERAL HIGHWAY ACTS, NOR THE EARLIER POST ROAD ACTS, DO THAT. THE STATE STATUTE IS NOT OBJECTIONABLE BECAUSE IT IS DESIGNED PRIMARILY TO PROMOTE GOOD SERVICE BY EXCLUDING UNNECESSARY COMPETING CARRIERS. THAT PURPOSE IS WITHIN THE STATE'S POLICE POWER.



THE CASE WAS THEN APPEALED TO THE UNITED STATES SUPREME COURT WHICH HELD THAT THIS ARGUMENT BY THE STATE'S ATTORNEYS WAS UNSOUND. IN ITS DECISION THE COURT STATED THAT IT MAY BE ASSUMED THAT THE STATE STATUTE - PROHIBITING COMMON CARRIERS FOR HIRE FROM USING THE HIGHWAYS WITHOUT FIRST SECURING A CERTIFICATE OF CONVENIENCE AND NECESSITY FROM THE STATE - WAS CONSISTENT WITH THE FOURTEENTH AMENDMENT; AND ALSO, THAT APPROPRIATE STATE REGULATIONS ADOPTED PRIMARILY TO PROMOTE SAFETY UPON THE HIGHWAYS AND CONSERVATION IN THEIR USE ARE NOT OBNOXIOUS TO THE COMMERCE CLAUSE, WHERE THE INDIRECT BURDEN IMPOSED UPON INTERSTATE COMMERCE IS NOT UNREASONABLE. THEY HELD, HOWEVER, THAT THE PROVISION HERE IN QUESTION IS OF A DIFFERENT CHARACTER. ITS PRIMARY PURPOSE IS NOT REGULATION WITH A VIEW TO SAFETY OR TO CONSERVATION OF THE HIGHWAYS, BUT THE PROHIBITION OF COMPETITION. IT DETERMINES NOT THE MANNER OF USE, BUT THE PERSONS BY WHOM THE HIGHWAYS MAY BE USED. IT PROHIBITS SUCH USE TO SOME PERSONS WHILE PERMITTING IT TO OTHERS FOR THE SAME PURPOSE AND IN THE SAME MANNER. MOREOVER, IT DETERMINES WHETHER THE PROHIBITION SHALL BE APPLIED BY RESORT, THROUGH STATE OFFICIALS, TO A TEST WHICH IS PECULIARLY WITHIN THE PROVINCE OF FEDERAL ACTION - THE EXISTENCE OF ADEQUATE FACILITIES FOR CONDUCTING INTERSTATE COMMERCE. THE VICE OF THE LEGISLATION IS DRAMATICALLY EXPOSED BY THE FACT THAT THE STATE OF OREGON HAD ISSUED ITS CERTIFICATE WHICH, DESPITE EXISTING FACILITIES, DECLARED THAT PUBLIC CONVENIENCE AND NECESSITY REQUIRED THE ESTABLISHMENT BY BUCK OF THE AUTO STAGE LINE BETWEEN SEATTLE AND PORTLAND. THUS, THE PROVISION OF THE WASHINGTON STATUTE IS A REGULATION, NOT OF THE USE OF ITS OWN HIGHWAYS, BUT OF INTERSTATE COMMERCE. ITS EFFECT UPON SUCH COMMERCE IS NOT MERELY TO BURDEN BUT TO OBSTRUCT IT. SUCH STATE ACTION IS FORBIDDEN BY THE COMMERCE CLAUSE. IT ALSO DEFEATS THE PURPOSE OF CONGRESS EXPRESSED IN THE LEGISLATION GIVING FEDERAL AID FOR THE CONSTRUCTION OF INTERSTATE HIGHWAYS. THE UNITED STATES SUPREME COURT, THEREFORE, REVERSED THE DECISION OF THE LOWER COURTS WHICH HAD BEEN FAVORABLE TO THE STATE.

A STATUTE IN MARYLAND PROHIBITS COMMON CARRIERS OF MERCHANDISE OR FREIGHT BY MOTOR VEHICLE FROM USING THE PUBLIC HIGHWAYS OVER SPECIFIED ROUTES WITHOUT A PERMIT. THE STATE PUBLIC SERVICE COMMISSION IS CHARGED WITH THE DUTY TO "INVESTIGATE THE EXPEDIENCY OF GRANTING SAID PERMIT" WHEN APPLIED FOR; AND IT IS AUTHORIZED TO REFUSE THE SAME IF IT "DEEMS THE GRANTING OF SUCH PERMIT PREJUDICIAL TO THE WELFARE AND CONVENIENCE OF THE PUBLIC."





THIS STATUTE WAS MADE AN ISSUE WHEN GEORGE W. BUSH AND SONS CO. APPLIED FOR A PERMIT TO DO AN EXCLUSIVELY INTERSTATE BUSINESS AS A COMMON CARRIER OF FREIGHT OVER SPECIFIED ROUTES, ALLEGING ITS WILLINGNESS AND INTENTION TO COMPLY WITH ALL APPLICABLE REGULATIONS CONCERNING THE OPERATION OF MOTOR VEHICLES. AFTER DUE HEARING THE PERMIT WAS DENIED. THE COMPANY THEN BROUGHT SUIT IN A COURT OF THE STATE TO RESTRAIN THE STATE OFFICIALS FROM INTERFERING WITH SUCH USE OF THE COMPANY'S TRUCKS. THE BILL ALLEGED, AND IT WAS ADMITTED BY DEMURRER, THAT THE HIGHWAYS WERE NOT UNDULY CONGESTED; THAT THEY ARE SO CONSTRUCTED THAT THEY CAN CARRY BURDENS HEAVIER THAN THAT WHICH WOULD BE IMPOSED BY THE COMPANY'S TRUCKS; THAT THE OPERATION OF ITS TRUCKS WOULD IMPOSE NO DIFFERENT BURDEN UPON THE HIGHWAYS THAN THE OPERATION OF THE TRUCKS OF THE SAME KIND AND CHARACTER BY PRIVATE PERSONS, WHICH WAS FREELY PERMITTED; AND THAT, IN REFUSING THE PERMIT, THE COMMISSION HAD CONSIDERED MERELY "WHETHER OR NOT EXISTING LINES OF TRANSPORTATION WOULD BE BENEFITED OR PREJUDICED AND IN THIS WAY THE PUBLIC INTEREST AFFECTED." THE COMPANY CLAIMED THAT, REGARDLESS OF PERMIT, IT WAS ENTITLED TO USE THE HIGHWAYS AS A COMMON CARRIER IN EXCLUSIVE- INTERSTATE COMMERCE. THE TRIAL COURT DISMISSED THE BILL AND ITS DECREE WAS AFFIRMED BY THE HIGHEST COURT IN THE STATE.

THE UNITED STATES SUPREME COURT, TO WHICH THE CASE WAS APPEALED BY BUSH, REVERSED THE DECISION OF THE LOWER COURTS. THEY HELD THAT, "THIS CASE PRESENTS TWO FEATURES WHICH WERE NOT PRESENT IN BUCK V. KUYKENDALL, NO. 345, DECIDED THIS DAY. THE FIRST IS THAT THE HIGHWAYS HERE IN QUESTION WERE NOT CONSTRUCTED OR IMPROVED WITH FEDERAL AID. THIS DIFFERENCE DOES NOT PREVENT THE APPLICATION OF THE RULE DECLARED IN THE BUCK CASE. THE FEDERAL-AID LEGISLATION IS OF SIGNIFICANCE, NOT BECAUSE OF THE AID GIVEN BY THE UNITED STATES FOR THE CONSTRUCTION OF PARTICULAR HIGHWAYS, BUT BECAUSE THOSE ACTS MAKE CLEAR THE PURPOSE OF CONGRESS THAT STATE HIGHWAYS SHALL BE OPEN TO INTERSTATE COMMERCE. THE SECOND FEATURE IS THAT HERE THE PERMIT WAS REFUSED BY THE COMMISSION, NOT IN OBEDIENCE TO A MANDATORY PROVISION OF THE STATE STATUTE, BUT IN THE EXERCISE, IN A PROPER MANNER, OF THE BROAD DISCRETION VESTED IN IT. THIS DIFFERENCE ALSO IS NOT OF LEGAL SIGNIFICANCE IN THIS CONNECTION. THE STATE ACTION IN THE BUCK CASE WAS HELD TO BE UNCONSTITUTIONAL, NOT BECAUSE THE STATUTE PRESCRIBED AN ARBITRARY TEST FOR THE GRANTING OF PERMITS, OR BECAUSE THE DIRECTOR OF PUBLIC WORKS HAD EXERCISED THE POWER CONFERRED ARBITRARILY OR UNREASONABLY, BUT BECAUSE THE STATUTE AS CONSTRUED AND APPLIED INVADDED A FIELD RESERVED BY THE COMMERCE CLAUSE FOR FEDERAL REGULATION."

[illegible]

JUSTICE McREYNOLDS, WHO DISSENTED FROM THE OPINION OF THE SUPREME COURT, EXPRESSED THE VIEW THAT IT WAS A STATE MATTER AND THAT REGULATIONS OF THIS CHARACTER FALL WITHIN THAT CLASS OF POWERS WHICH MAY BE EXERCISED BY THE STATES UNTIL CONGRESS HAS SEEN FIT TO ACT UPON THE SUBJECT.



UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF PUBLIC ROADS

STATUS OF CURRENT FEDERAL AID ROAD WORK

FOR THE FISCAL YEAR ENDING JUNE 30, 1928

AS OF JULY 31, 1927

B.P.R.-F.A.-A-1  
M-JULY, 1927 -A

STATES	BALANCE OF CURRENT FUND AVAILABLE FOR NEW PROJECTS	* UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			AMOUNT PAID DURING FISCAL YEAR			COMPLETED AND PAID DURING FISCAL YEAR			AGREEMENTS NOW IN FORCE			P. S. & E. RECOMMENDED FOR APPROVAL BY DISTRICT ENGINEER			STATES
		FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	
ALABAMA	2,951,059.59	3,259,311.99	395.6	1.9	50,894.48	2.8		165,340.42						3,210,395.64	392.1	1.9	110,109.83	5.3		ALABAMA
ARIZONA	2,919,285.82	1,931,235.28	92.7	4.4	347,611.53	19.1		92,085.11						1,291,583.47	91.8	4.4	17,284.44	2.5		ARIZONA
ARKANSAS	1,530,275.03	1,431,935.52	211.3		284,001.03	19.5		5,899.44			12,354.37	0.1		1,549,552.55	228.2		155,333.20	2.5		ARKANSAS
CALIFORNIA	4,035,337.45	3,425,332.39	138.3	0.4	92,014.56	4.5		210,115.71			224,971.31	15.9		3,255,938.15	133.6	0.4	171,781.47	5.1		CALIFORNIA
CONNECTICUT	2,320,325.00	2,320,325.00	29.1		2,320,325.00	29.1		65,370.64			48,486.94	0.5		1,755,555.71	74.2		59,593.39	2.8		CONNECTICUT
DELAWARE	4,319,289	312,891.57	32.3	1.3	175,900.72	15.5		189,930.94						231,954.57	32.3		197,837.72	15.5	1.9	DELAWARE
FLORIDA	943,567.53	3,917,573.09	130.1	24.9	398,091.78	24.1		219,930.94			94,260.00	6.3		3,735,287.89	194.2	24.9	590,395.98	20.0		FLORIDA
GEORGIA	553,344.57	4,253,317.42	345.0	119.9	203,353.84	8.4	5.3	180,073.40			193,943.57	13.6		3,539,847.77	305.5	109.1	757,933.49	48.9	24.0	GEORGIA
ILLINOIS	505,707.11	1,540,701.94	183.4	17.4	270,883.89	25.0	9.5	159,509.93						1,501,459.32	183.4	16.9	310,125.91	25.0	10.4	ILLINOIS
INDIANA	2,352,134.45	7,595,345.44	435.9		737,574.97	53.5	0.5	135,133.07			92,273.14	6.4		7,539,411.50	435.7		2,713,599.53	53.5	3.0	INDIANA
IOWA	134,342.89	5,942,815.47	537.1	22.3	300,298.99	11.6	7.8							6,943,957.73	537.1	22.7	41,157.53			IOWA
KANSAS	507,631.54	5,702,839.05	741.3	7.5	490,379.53	93.1	6.9	257,923.20			101,233.29	11.4		5,134,839.95	670.3	8.4	1,058,778.74	154.1	6.1	KANSAS
KENTUCKY	99,091.51	1,889,432.48	435.4	52.9	412,849.17	29.9	25.9	174,575.97			128,657.29	9.4		4,285,430.41	421.9	57.7	507,851.24	43.4	22.1	KENTUCKY
LOUISIANA	954,440.33	1,889,179.34	122.5	7.5	309,000.00	0.9		61,914.04			70,203.32	10.7		1,859,179.94	122.5	7.5	309,000.00	0.9		LOUISIANA
MAINE	1,154,260.09	3,433,327.05	31.5		12,521.00	10.1		27,127.11			47,040.48	5.2		3,416,283.05	31.5		897,585.00	4.5		MAINE
MARYLAND	2,035,335.53	1,439,230.59	89.5		132,295.57	10.9		50,955.00			50,955.00	3.4		1,446,780.49	88.7		204,723.57	13.7		MARYLAND
MASSACHUSETTS	1,955,619.53	5,431,846.35	369.9	12.6	790,125.00	40.9	6.5	357,325.88						5,003,222.35	357.2	12.5	1,228,729.00	53.5	6.5	MASSACHUSETTS
MICHIGAN	550,475.43	2,114,939.50	779.3	115.7	1,020.00	11.1								2,115,893.50	399.4	119.7				MICHIGAN
MINNESOTA	793,915.76	3,357,827.47	375.5	29.5	259,792.68	48.4		132,195.53			21,156.48	3.8		3,138,974.68	349.3	14.7	477,645.49	75.7	14.9	MINNESOTA
MISSISSIPPI	337,872.57	3,503,728.88	247.9	44.7	1,747,198.77	74.7	0.3	173,795.13			221,824.30	22.9		3,151,865.72	288.3	34.9	729,270.93	34.3	10.2	MISSISSIPPI
MISSOURI	4,327,172.75	6,311,203.58	1,298.1	58.9	1,029,504.31	125.1	235.5	198,525.05			314,095.57	80.3	57.1	6,386,822.37	1,281.6	599.2	954,500.92	171.5	135.2	MISSOURI
NEBRASKA	740,732.00	1,294,255.53	177.9	26.2	100,430.91	17.8		57,775.07			19,135.69	4.9		1,294,255.53	177.8	26.2	109,045.53	17.8		NEBRASKA
NEVADA	54,345.80	501,625.45	38.9		44,520.00	5.2		7,335.70			7,335.70	0.7		500,349.92	33.4		193,555.53	11.7		NEVADA
NEW HAMPSHIRE	71,127.95	1,724,059.55	111.5			3.0		84,960.00			94,960.00	5.7		1,450,893.56	97.3		257,685.00	17.2		NEW HAMPSHIRE
NEW JERSEY	1,335,135.72	2,598,095.90	233.6		2,514,457.50	150.8	8.6	218,234.63			19,319.32	13.7		3,151,081.55	233.6		351,081.55	34.0	8.5	NEW JERSEY
NEW MEXICO	751,702.37	1,598,044.97	100.4	7.2	595,443.60	24.0	21.6	205,582.21			137,531.34	13.7		1,431,705.38	100.4		672,782.55	41.9	23.8	NEW MEXICO
NORTH CAROLINA	354,782.26	3,241,293.59	882.3	265.0	591,250.17	270.2	176.9	146,910.31						3,261,776.05	882.3	354.4	570,735.01	233.3	87.5	NORTH CAROLINA
NORTH DAKOTA	4,071,013.17	4,473,620.07	329.3	4.2	522,135.00	33.8		133,223.41			83,800.00	5.0		4,282,489.92	321.0	4.2	719,355.45	42.1		NORTH DAKOTA
OHIO	1,324,221.43	1,764,345.57	246.2	27.8	589,674.70	99.0	10.8	115,676.92			8,846.09	5.0		1,994,474.01	257.3	38.5	338,547.26	77.9		OHIO
OKLAHOMA	99,871.00	1,707,528.59	82.4	35.8	25,695.80	9.9		50,955.00						1,212,751.93	97.5	35.8	120,453.13	4.9		OKLAHOMA
OREGON	1,341,084.00	1,341,084.00	32.8		1,135,563.91	10.2		201,503.58						1,457,313.74	32.8		1,457,313.74	32.8		OREGON
PENNSYLVANIA	2,968,901.40	2,968,901.40	247.1	30.6	52,000.00	15.5	10.8	158,825.41			57,825.39	23.1		2,738,041.11	230.5	19.2	242,877.39	32.0	22.2	PENNSYLVANIA
RHODE ISLAND	43,120.44	2,030,331.29	655.2	73.3	249,050.74	101.0	39.3	79,251.45						2,030,331.29	655.2	82.4	244,940.97	51.1	35.2	RHODE ISLAND
SOUTH CAROLINA	1,376,155.59	3,514,387.07	225.7	60.3	357,056.79	31.7		49,073.80						3,313,903.78	203.0	42.7	657,640.08	54.4	17.6	SOUTH CAROLINA
TENNESSEE	5,573,935.98	5,503,161.05	497.5	196.4	1,007,930.61	62.6	61.9	376,677.62			449,844.39	30.8	25.3	6,677,152.79	483.2	214.5	993,688.98	75.9	33.7	TENNESSEE
TEXAS	351,433.41	1,658,315.58	155.0		759,598.65	69.0	7.5	38,045.75			159,256.22	13.4		1,922,036.58	155.0		230,382.29	18.9	7.3	TEXAS
UTAH	1,970,948.28	1,970,948.28	109.2		345,874.43	15.6	4.0	215,097.61			72,129.90	6.5		2,130,735.71	115.6	4.0	196,087.00	9.0		UTAH
VIRGINIA	1,215,155.05	1,575,600.00	63.4		55,020.00	19.2		121,533.10			75,000.00	4.8		1,740,900.00	73.6					VIRGINIA
WASHINGTON	39,341.27	2,934,151.85	238.2	12.0	598,575.47	44.1	7.0	598,575.47			39,828.47	1.3		2,841,704.36	237.1	12.0	691,152.35	45.2	7.0	WASHINGTON
WEST VIRGINIA	2,377,073.83	4,980,059.80	394.5	47.0	159,990.00	25.0	1.6	4,530.50			38,828.47	1.3		4,533,886.90	370.4	39.4	511,133.00	49.1	9.2	WEST VIRGINIA
WISCONSIN	562,244.86	1,789,338.73	203.0	101.9	45,077.34	6.6		40,395.00			22,216.00	4.2		1,824,084.87	193.1	65.9	351,631.40	39.9	42.5	WISCONSIN
WYOMING	807,975.39	582,382.64	29.7											582,382.64	29.7					WYOMING
TOTALS	43,944,100.09	145,571,490.76	13,585.8	2,150.9	22,259,450.82	2,203.4	709.4	5,411,046.79			2,977,277.09	337.7	84.9	145,755,921.58	13,974.0	2,283.6	22,214,009.50	2,015.2	586.7	TOTALS

\* INCLUDES PROJECTS REPORTED COMPLETED (FINAL VOUCHERS NOT YET PAID) TOTALING: FEDERAL AID \$39,575,452.01; MILEAGE ORIGINAL 3,550.6; MILES STAGE 744.4





DIATOMACEOUS EARTH ADMIXTURE PROPOSED FOR MARYLAND CONCRETE  
PAVEMENT TEST

CONTRIBUTED BY F. H. JACKSON OF THE DIVISION OF TESTS

A FIELD DEMONSTRATION OF THE EFFECT OF DIATOMACEOUS EARTH, AS AN ADMIXTURE, ON THE QUALITY OF CONCRETE PAVEMENT IS TO BE CONDUCTED BY THE MARYLAND STATE ROADS COMMISSION IN COOPERATION WITH THE BUREAU. FOUR EXPERIMENTAL SECTIONS, EACH ONE-QUARTER MILE IN LENGTH, ARE TO BE CONSTRUCTED ON THE CRAIN HIGHWAY, IN PRINCE GEORGES COUNTY, MD. THIS EXPERIMENT IS A CONTINUATION OF THE CURING EXPERIMENTS ON SODIUM SILICATE AND CALCIUM CHLORIDE CARRIED OUT ON THE CRAIN HIGHWAY IN 1926. THREE GRADES OF DIATOMACEOUS EARTH ARE TO BE TRIED IN COMPARISON WITH ONE PLAIN SECTION, AS FOLLOWS:

- SECTION 1 - 1:2:4 - PLAIN CONCRETE
- " 2 - 1:2:4 -  $2\frac{1}{3}$  PER CENT "CELITE"
- " 3 - 1:2:4 -  $2\frac{1}{3}$  PER CENT DIATOMITE (C-MIX)
- " 4 - 1:2:4 -  $2\frac{1}{3}$  PER CENT DIATOMACEOUS EARTH.

THE SECTIONS ARE ALL TO BE CONSTRUCTED AND CURED IN THE SAME MANNER, AS NEARLY AS POSSIBLE. THE CONSISTENCY OF THE CONCRETE WILL BE MADE IN EACH CASE AS DRY AS POSSIBLE WITHOUT INTERFERING WITH THE PROPER HANDLING AND FINISHING OF THE CONCRETE. NO ATTEMPT WILL BE MADE TO MAINTAIN THE SAME SLUMP ON ALL FOUR SECTIONS. HOWEVER, ACTUAL DETERMINATIONS OF THE SLUMP WILL BE MADE, AS WELL AS DETAILED OBSERVATIONS REGARDING THE APPARENT WORKABILITY OF THE CONCRETE. DETERMINATIONS OF THE AMOUNT OF WATER USED IN EACH SECTION WILL BE MADE, AS ACCURATELY AS POSSIBLE, AND WITH SPECIAL REFERENCE AS TO WHETHER MORE OR LESS WATER IS REQUIRED FOR THE SECTIONS IN WHICH THE ADMIXTURES ARE USED, AS COMPARED WITH THE PLAIN CONCRETE.

FOR EACH DAY'S RUN, A SET OF FIVE 6 BY 6 BY 30-INCH BEAMS ARE TO BE TESTED AT THE AGES OF 7, 28, 90, 180, AND 360 DAYS, RESPECTIVELY. THE BEAMS ARE TO REMAIN IN THE MOLDS FOR 24 HOURS AND WILL THEN BE CURED AT THE SITE OF THE WORK, UNTIL TESTED. SEVEN AND 28-DAY BEAMS WILL BE TESTED WITH A PORTABLE DEVICE AT THE SITE OF THE WORK. BEAMS FOR THE LATER TESTS WILL BE TAKEN TO THE ARLINGTON LABORATORY OF THE BUREAU.

SUPPLEMENTING THE FIELD WORK OUTLINED ABOVE, A SERIES OF LABORATORY TESTS WILL BE MADE TO DETERMINE THE RELATIVE YIELDS OBTAINED WITH THE MATERIALS, PROPORTIONS, AND CONSISTENCIES USED IN THE EXPERIMENTS PREVIOUSLY DESCRIBED.





VIRGINIA DEMONSTRATION ROAD BEING EXTENDED FOR MORE  
EXTENSIVE INVESTIGATIONS ON AGGREGATE AND CURING

CONTRIBUTED BY C. A. HOGENTOGLER OF THE DIVISION OF TESTS

THE VIRGINIA DEMONSTRATION ROAD IS BEING EXTENDED, BY BUILDING AN ADDITIONAL FIVE MILES OF CONCRETE PAVEMENT, IN ORDER TO MAKE MORE EXTENSIVE INVESTIGATIONS AS TO THE EFFECTS, UPON THE COMPLETED PAVEMENT, OF VARIOUS TYPES OF AGGREGATE AND METHODS OF CURING. THE CONSTRUCTION OF THE ORIGINAL TEN MILES OF THIS ROAD, AS A COOPERATIVE RESEARCH PROJECT OF THE BUREAU AND THE VIRGINIA STATE HIGHWAY COMMISSION, WAS COMPLETED IN MAY, 1927. A GENERAL OUTLINE OF THIS PROJECT WAS GIVEN IN THE AUGUST, 1926, ISSUE OF PUBLIC ROADS. THE CONSTRUCTION OF THE PRESENT 5-MILE EXTENSION OF THE PAVEMENT WHICH WAS BEGUN IN JULY, 1927, IS EXPECTED TO BE COMPLETED THE LATTER PART OF THIS YEAR.

THE 5-MILE EXTENSION INCLUDES TWO 1/4-MILE UNITS BUILT WITH GRAVEL AGGREGATE - ONE WITH COARSE GRAVEL AND THE OTHER WITH FINE. ADJOINING THESE SECTIONS THERE IS A 1/2-MILE LENGTH IN WHICH STONE FROM A LOCAL QUARRY IS USED AS THE COARSE AGGREGATE. FOLLOWING THIS A CURING INVESTIGATION WILL BE CARRIED OUT ON FOUR 1,500-FOOT SECTIONS, EACH TREATED WITH ONE OF THE FOLLOWING MATERIALS:

1. - "CAL" AS AN ADMIXTURE. THIS IS A COMMERCIAL PRODUCT CONSISTING OF A MIXTURE OF CALCIUM CHLORIDE AND HYDRATED LIME.
2. - CALCIUM CHLORIDE AS AN ADMIXTURE.
3. - SODIUM SILICATE AS A SURFACE APPLICATION.
4. - STANDARD WET-EARTH COVERING.

OBSERVATIONS SIMILAR TO THOSE ON THE ORIGINAL TEN MILES, WILL BE MADE ON THE NEW EXTENSION WITH REGARD TO THE VARIABLES OF SUBGRADE, CLIMATE, TRAFFIC, AND CONSTRUCTION. THE NEW STUDIES WILL INCLUDE MODULUS OF RUPTURE TESTS OF BEAMS MADE OF REPRESENTATIVE SAMPLES OF THE CONCRETE MIXTURE. FOR EACH OF THE NEW CURING SECTIONS THERE WILL BE MOLDED FORTY 6 x 6 x 30-INCH BEAMS, SPECIMENS OF WHICH WILL BE BROKEN AT THE AGES OF 1, 2, 4, 7, 14, 21, 28, 90, 180, AND 360 DAYS. ONE-HALF OF THE BEAMS FROM EACH SECTION WILL BE CURED BY THE SAME METHOD USED IN THE CONSTRUCTION OF THE SECTION, WHILE THE OTHER HALF WILL RECEIVE NO CURING OTHER THAN A WET-BURLAP COVERING FOR 24 HOURS.

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(NOT FOR RELEASE)

NEW RESEARCH PROJECT APPROVED

TITLE: MOTOR TRUCK IMPACT AS INFLUENCED BY WHEEL TYPE.

APPROVED: JUNE 14, 1927.

LEADER: JAMES A. BUCHANAN.

OBJECT: TO ESTABLISH DATA FROM WHICH MAY BE DETERMINED THE RELATIVE CUSHIONING EFFECT OF VARIOUS TYPES OF MOTOR TRUCK WHEELS.

PROCEDURE: IMPACT TESTS WILL BE MADE ON VARIOUS TYPES OF CUSHION AND RIGID TRUCK WHEELS. THESE TESTS, IN GENERAL, WILL BE SIMILAR IN TYPE BUT MUCH LESS EXTENSIVE THAN THE TESTS RECENTLY CONDUCTED WITH VARIOUS TIRE EQUIPMENTS. THE OPERATING CONDITIONS (LOAD, SPEED, TIRES, ETC.) WILL BE CONSTANT, EXCEPT FOR CHANGES IN WHEEL TYPES; AND BY A COMPARISON OF THE IMPACT FORCES PRODUCED, A DETERMINATION WILL BE MADE OF THE CUSHIONING QUALITIES, IF ANY, INHERENT IN THE VARIOUS WHEEL TYPES IN ACTUAL USE. IT WILL BE DESIRABLE TO RESTRICT SUCH TESTS TO THE USE OF ONLY ONE TRUCK IN ORDER TO ELIMINATE A POSSIBLE INFLUENCE OF TRUCK DESIGN. FOR COMPARISON WITH THE BEST CONDITIONS OF RIGID-WHEEL OPERATION, A PNEUMATIC TIRE STEEL-DISC WHEEL COMBINATION WILL BE INCLUDED.

THE FOLLOWING TENTATIVE SCHEDULE OF TESTS IS PROPOSED:

TRUCK: 2-TON.

LOADS: 2500 LBS. AND 5000 LBS. PER REAR WHEEL.

TIRES: 36 INCH BY 6 INCH DUAL PNEUMATIC  
36 INCH BY 5 INCH DUAL NEW CUSHION  
36 INCH BY 4 INCH DUAL WORN SOLID

SPEEDS: FULL RANGE FROM MINIMUM TO MAXIMUM.

ROAD ROUGHNESS: THE ARTIFICIALLY ROUGHENED TEST ROAD AT ARLINGTON, WHICH INCLUDES VARIOUS SIZES AND TYPES OF STEEL OBSTRUCTIONS BOLTED TO A CONCRETE ROAD.

SELECTED NEARBY HIGHWAYS OF VARIOUS ROUGHNESSES.



WHEELS: STEEL DISC (FOR PNEUMATIC TIRES)  
WOOD SPOKE - METAL FELLOE (RIGID TYPE)  
CUSHION TYPE - MAKES A, B, C, ETC.

INSTRUMENTS: THE BUREAU COIL-SPRING ACCELEROMETER MOUNTED TO RECORD THE VERTICAL ACCELERATIONS OF THE RIGHT REAR WHEEL. THE UNSPRUNG COMPONENT WILL BE COMPUTED FROM THE ACCELERATIONS FOR THE VARIOUS TEST CONDITIONS AND ADDED TO THE STATIC SPRUNG COMPONENT IN ORDER TO ARRIVE AT THE TOTAL VERTICAL IMPACT REACTION. THIS PROCEDURE WAS SUCCESSFULLY FOLLOWED IN THE RECENT "ISOGRAM" TESTS AND MATERIALLY SHORTENED THE WORK.

IN ADDITION TO THE ABOVE, IT MAY BE OF ADVANTAGE TO CONDUCT SELECTED TESTS ON THE STATIC AND IMPACT TESTING MACHINES AND ON THE REACTION WHEEL.

COOPERATION: NONE. THE MANUFACTURERS OF THE TRUCK, TIRES, AND WHEELS WILL BE INVITED TO MAKE SUGGESTIONS AND WILL BE GIVEN THE OPPORTUNITY TO HAVE REPRESENTATIVES OBSERVE THE TESTS. THE CONSENT OF THE HIGHWAY AUTHORITIES OF THE DISTRICT OF COLUMBIA AND THE STATE OF VIRGINIA WILL BE OBTAINED PRIOR TO THE USE OF HIGHWAYS UNDER THE RESPECTIVE JURISDICTIONS. THE BUREAU OF STANDARDS HAS ASKED TO BE PERMITTED TO FURNISH AN OBSERVER DURING THE TESTS.

LOCATION: THE ARLINGTON EXPERIMENTAL FARM AND NEARBY HIGHWAYS WHERE SUITABLE ROAD SURFACES MAY BE FOUND.

LEGAL AUTHORITY: SECTION 21 OF THE FEDERAL HIGHWAY ACT, APPROVED NOVEMBER 9, 1921 (42 STAT. 212) FOR ADMINISTERING PROVISIONS OF THE ACT AND FOR CARRYING ON NECESSARY HIGHWAY RESEARCH AND INVESTIGATIONAL STUDIES. APPROPRIATION DESIGNATION: "COOPERATIVE CONSTRUCTION OF RURAL POST ROADS, ADMINISTRATIVE EXPENSES."

PROPOSED EXPENDITURES: \$3,500.00, BASED ON AN ESTIMATED TEST PERIOD OF THREE MONTHS AND INCLUDING ALL SALARIES, MATERIALS, SUPPLIES, OPERATION OF EQUIPMENT AND CONTINGENCIES.





HISTORY: IN THE DECEMBER, 1921, ISSUE OF PUBLIC ROADS, RESULTS OF IMPACT TESTS ON SEVERAL CUSHION WHEELS WERE PUBLISHED AND INCLUDE THE ONLY AVAILABLE DATA ON THIS SUBJECT. A NUMBER OF WHEEL COMPANIES HAVE ADVANCED CLAIMS THAT A PROTECTION TO THE ROAD IS AFFORDED BY THE USE OF CUSHION WHEELS.

SINCE THESE EARLIER TESTS WERE MADE, IMPROVED INSTRUMENTS AND METHODS FOR MEASURING IMPACT HAVE BEEN DEVELOPED. WITH THESE IT SHOULD BE POSSIBLE TO DETERMINE MORE DEFINITELY WHETHER OR NOT ANY PROTECTION IS AFFORDED THE HIGHWAY BY THE USE OF CUSHION WHEELS.

DATE EFFECTIVE: IT IS PROPOSED TO CONDUCT THIS WORK DURING THE SUMMER MONTHS OF 1927. THE PROGRAM CAN BE CARRIED OUT IN CONJUNCTION WITH THE OTHER MOTOR-TRUCK-IMPACT WORK NOW ON HAND. MUCH OF THE EQUIPMENT AND APPARATUS IS NOW AT THE ARLINGTON EXPERIMENTAL FARM.

